when compared with aerobic growth. He also finds no coincidence between intensity of "intramolecular" respiration and of anaerobic growth. The conclusions of these workers are drawn from too few and these mainly cultivated forms. Study of wild forms of varied habits may show very different results. —WILLIAM CROCKER.

Structure of the spore wall.—A notable addition to our knowledge of the structure and development of the spore wall is contributed by BEER[31] in a study of the young pollen grains of *Ipomea purpurea*. At the conclusion of the reduction division, the tetrads of young pollen grains become surrounded by massive mucilaginous walls, which show the reactions of callose and pectose. Within this mucilaginous wall, and surrounding each young pollen grain, is another mucilaginous wall with the same reactions. This second wall is called the "special wall," a term suggested by STRASBURGER to replace the awkward and misleading term "special mother cell wall." The exine is deposited by the pollen protoplast upon the inner surface of the special wall, and at first is homogenous, but soon becomes differentiated into an outer lamella, with a network of thickening bands on its inner surface, and at the intersection of the bands are the rudiments of the spines. At this stage a clear space is seen between the outer lamella and the thickening bands, and in this space the rodlets characteristic of the mature pollen develop. The spines project into the pollen cavity before they begin to appear externally. The intine develops within the exine as a thin layer, with thicker portions where it protrudes into the exit pores. Chemically, it consists of pectic bodies associated with some cellulose. In older pollen grains the exine consists of a delicate outer lamella perforated with countless pores, so that it really forms a reticulum with open meshes, beneath which are the thickening bands constituting the mesospore, perforated by the narrow exit pores for the pollen tubes. The outer lamella of the exine dips into the exit pores and covers the protrusions of the intine at these spots. Since nearly the entire growth of the rodlets and spines takes place after they have become separated from the protoplast, it is concluded that they are able to develop without any direct contact with the protoplasm.

This short paper presents a thorough study of a single species and suggests a series of investigations, for it may be predicted with the utmost confidence that the account will not hold for angiosperms in general, and the author makes no such claim. After various types of pollen grains have received similar attention, it will be time to generalize.—CHARLES J. CHAMBERLAIN.

Chemotaxy.—SHIBATA[32] gives the first part of a full statement of his extensive work on chemotactic responses of the spermatozoids of pteridophytes. This

[31] BEER, RUDOLF, Studies in spore development. Ann. Botany **25**:199–214. *pl. 13*. 1911.

[32] SHIBATA, K., Untersuchungen über die Chemotaxis der Pteridophyten Spermatozoiden. Jahrb. Wiss. Bot. **49**:1–60. 1911.

part deals with positive reactions, while the second part will deal with the negative. SHIBATA himself has contributed no small part of the knowledge in this field, especially with the forms *Isoetes*, *Salvinia*, and *Equisetum*. The paper is divided into seven sections dealing with the following phases of the subject: (1) introduction and methods, (2) action of organic acids, (3) action of metallic ions, (4) action of H and OH ions, (5) action of alkaloids and other organic bases, (6) application of the Weber-Fechner Law, (7) the classes of chemotactic sensibility and their relation to each other.

The body of facts is so great that no statement of it can be attempted here. Some of the generalizations, however, especially those derived from the seventh section, are of considerable interest. SHIBATA concludes that there exists in the pteridophytes three categories of positive chemotactic sensibility: (1) for the anions of malic acid and of the related dicarboxyl acids, (2) for the OH ion (only in *Isoetes*), (3) for cations of metals and hydrogen and for alkaloids. The three categories are entirely independent, as indicated by the lack of antagonistic action between members of different categories. Within the same category one member dulls the action of any other. In general, the dulling effect is proportional to the attractive value, but this is not always the case. Citrate, which is 1/10 as powerful in attracting *Salvinia* sperms as is maleate, is just as effective in dulling the action of maleate as is maleate itself. SHIBATA believes that in chemo-perception within a given category either the first links or at least early links in the chain of perception are identical. He contrasts this situation with that found by KNIEP in certain bacterial forms, who concluded that each individual substance is separately perceived. He found no dulling action between any two chemotactically active substances.—WILLIAM CROCKER.

Coremia formation by Penicillium.—By methods which at the present stage of plant physiology appear somewhat crude and superficial, WÄCHTER[33] has attempted to find the factors influencing the formation of coremia in a form of *Penicillium*, which he designates by the usual name of *P. glaucum*, but which can be easily identified as *P. expansum* Link. The method of study consisted in growing the fungus on sterilized slices of various fruits and vegetables, and on the expressed juices of these, and also on an inorganic nutrient solution with various concentrations of sugar, this being the only medium approximating anything like known conditions. When the results are sifted, we are left in the same position as before as to the factors which influence the formation of coremia, namely, that when grown on various substrata of unknown composition this form (like other coremia-forming species) sometimes forms coremia and sometimes not, a fact, moreover, clearly formulated by THOM[34] in regard to this and other species of similar habit. The work of

[33] WÄCHTER, W., Ueber die Koremien von *Penicillium glaucum*. Jahrb. Wiss. Bot. **48**:521–548. 1910.

[34] THOM, CH., Cultural studies of species of *Penicillium*. U.S. Dept. Agr., Bur. Animal Industry, Bull. 118. 1910.